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MAIR AVGANIM

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Filed:

For: **auto-torque, tamper-proof screws**

Art Group:

Examiner:

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COUNTRY	APPLICATION NUMBER	DATE OF FILING
Israel	151060	4 August 2002

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Respectfully submitted,

Blakely, Sokoloff, Taylor & Zafman LLP

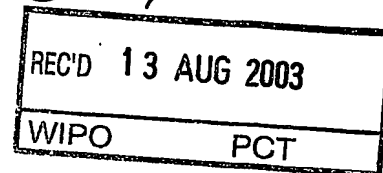
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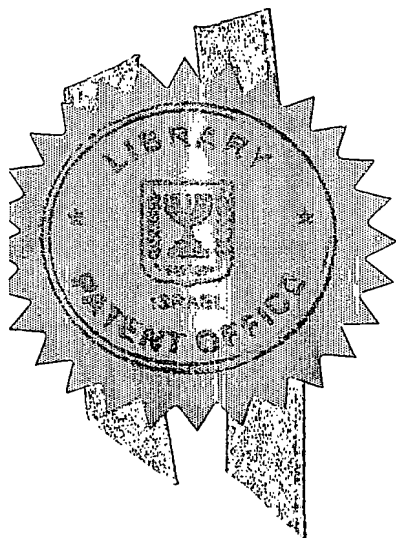
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Application for Patent

מספר: Number	151060
תאריך: Date	04 AUG 2002
הוקדם/נדחה: Ante/Post-dated	

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ברגים חסיני חבלה ומותאמי פיתול מעצמם  
AUTO-TORQUE, TAMPER-PROOF SCREWS

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אנגלית:  
(English)

hereby apply for a patent to be granted in respect thereof

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מבקשת פטנט from Appl.		* לבקשה/פטנט to Patent/Appl.		מספר/סימן Number/Mark	תאריך Date
No.	מס'	No.	מס'		מדינת האגוד Convention Country
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המען למסירת מסמכים בישראל: Address for Service in Israel		דניאל פריימן, עו"ד 29814 ת.ד. 61297 תל אביב			
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**AUTO-TORQUE, TAMPER-PROOF SCREWS**

# **AUTO-TORQUE, TAMPER-PROOF SCREWS**

## **FIELD OF THE INVENTION**

The invention relates to screws, and more specifically to restricted torque fastening screws.

## **BACKGROUND OF THE INVENTION**

In the relevant industries, it is often required that fastening screws be tightened by a limited, controlled force, in order to avoid damage to the equipment or to fulfill other conditions, e.g. in case of a cover with a rubber seal which must not become over-squeezed.

Other, related examples, are cases where it is requested that once tightened, the screw cannot be slackened by ordinary tools such as a screwdriver, or at all.

Alternatively, a demand may be posed that it would be possible to unscrew the screw, but there will be clear and unmistakable indication that the screw has been tampered with by an unauthorized person.

The invention aims at proposing a solution satisfying any and all of these requisites.

It is a further object of the invention that the screw heads be produced by forging.

## **SUMMARY OF THE INVENTION**

Thus provided according to the invention is a screw having a screw-threaded shank and a head, the head being provided with at least one screwdriver-receiving portion defined between a first, integrally formed

projection of a pre-set, relatively low, shearing force resisting strength, and a second, integrally formed projection of a relatively high shearing force resisting strength.

Preferably, the first projection is of a generally right-angled triangular cross-section in a plane normal to the radial direction of the screw head.

## **BRIEF DESCRIPTION OF THE DRAWINGS**

These and additional constructional features and advantages of the invention will become more clearly understood in the light of the ensuing description of the preferred embodiments thereof, given by way of example only with reference to the accompanying drawings, wherein -

Fig. 1 is a three-dimensional view of a screw according to a first embodiment of the invention;

Fig. 2 is a top view of the screw of Fig. 1;

Fig. 3 is a section taken along line III-III of Fig. 2;

Fig. 4 is a side view of the screw of Fig. 1;

Fig. 5 illustrates a tool for tightening the screw of Fig. 1

Fig. 6 is a three dimensional view of a screw according to a second embodiment of the invention;

Fig. 7 is a top view of the screw of Fig. 6;

Fig. 8 is a side view of the screw of Fig. 7;

Fig. 9 is a three-dimensional view of a screw according to a third embodiment of the invention;

Fig. 10 is a top view of the screw of Fig. 9;

Fig. 11 is a side view of the screw of Fig. 10;  
Fig. 12 is a partial cross-sectional view taken along line XII-XII of Fig. 10;  
Fig. 13a schematically shows the tightening operation of the screw of Fig. 9 by a designated tool;  
Fig. 13b shows the unscrewing operation of the screw using the same tool;  
Fig. 14 is a three dimensional view of a screw according to a fourth embodiment of the invention;  
Fig. 15 is a top view of the screw of Fig. 14;  
Fig. 16 is a side view of the screw of Fig. 15;  
Fig. 17a shows the tightening operation of the screw at Fig. 14 by a designated tool; and  
Fig. 17b shows the unscrewing of the screw.

## **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

The embodiment of Figs 1-4 relates to a screw with limited tightening torque and indication if opened without authorization. The indication is given in such a manner that if the screw has been unscrewed - it cannot be closed again whatsoever.

Hence, the screw generally denoted 10 comprises a shoulder (machine-screw) head 12 and a shank 14. As will be made clear, the screw can be of any kind, either of the standard or of special design.

A pattern of cavities or depressions is applied to the top of the head 12, most conveniently and as normally applied in the production of bolts and

screws by forging, in a one-time operation, as will be now described with respect to the present example. Variations and modifications of the pattern will be readily apprehended after understanding the design principles governing this embodiment.

At least one - but preferably three - radially extending slots 16, 18, 20 are present. The slot 16 (see Fig. 3) is delimited at one side thereof by a first projection 16a of a generally right-angled triangular cross-section (seen in a plane normal to the radial direction of the head 12). A curved surface 16b slopes from the root of the projection 16a up to the original top level of the head 12 (projection 18c - see below).

At the other side of the slot 16 there is left a solid, generally isosceles triangular cross-section projection 16c as seen in a plane normal to the axis of the head 12.

Similarly, slot 18 has triangular projection 18a and curved surface 18b at one side, and projection 18c at the other side; and the same applies to the slot 20. Preferably, a circular depression 22 is made at the center (the apexes of the triangles 16c, 18c, and 20c).

An operating tool or driver for the screw 10 is shown in Fig. 5. The tool denoted 24 has a hand gripping handle (or electric screwdriver standard coupling tip) 26, three elongated bars 26a, 26b, 26c and a central pin 28, designed to fit the slots 16, 18, 20, and the depression (or boss) 22, respectively.

In use, namely fastening a workpiece by the screw 10, the screw is turned by the tool 24 and tightened by an increased torque until the projections 16a,

18a, and 20a are simultaneously torn or shaved off by the shear force applied to the respective roots thereof.

The amount of the maximum applicable torque can be pre-determined by correctly calculating the collective shear strength that will cause the breaking of the projections, the relevant parameters being the cross-sectional area of the roots and the shear stress of the material the screw is made of.

Once broken, further rotation of the tool would simply "throw" the tool out of the respective slots to merely idle over the top of the screw head 12.

However, and in that respect uniquely different from prior art auto-torque screws, although opening of the screw 10 remains possible, by turning the head 12 in the opposite (counter-clockwise) direction by the tool 24, the re-fastening thereof is not possible.

Hence, let us take the following frequent example where a manufacturer of certain equipment makes it a condition to the validity of its warranty that no one except authorized personnel is allowed to dismantle any part of it. Once a purchaser attempts to release the screws by himself, he will be compelled to replace them by "ordinary" screws when bringing the equipment to repair under the warranty, which will immediately indicate that the above condition has been violated and free the manufacturer of its obligation.

Figs. 6-8 exemplify application of the invention to a flat head (wood) screw and is otherwise analogous to the preceding embodiment and therefore similar reference numerals are used.

Hence, provided at the screw 110 are three slots 116, 118, 120 and their related shearable projections 116a-120a, etc.

In the modified embodiment of Figs. 9-13, no screwdriver slots in the normal sense of the term are present, but rather two sets of unidirectional projections are formed as will now be described. Machine screw 210 with shoulder head 212 is formed with a first set of projections - three in the described example - denoted 230, 232, and 234 which are functional for closing the screw, and a second set of projections 240, 242, 244 for unscrewing, and central bore (or projection, at the option of the designer) 250.

Again emphasized is that this pattern is easily attained by press-forging so that, as in the preceding embodiment, the projections are integrally formed with the head 212.

The first set of projections 230-234 have a right-angled triangle cross-section. The hypotenuses of the triangles extend radially facing the same clockwise direction.

The second set of projections 240-244 are spaced from the projections of the first set both in radial and in the angular directions, with hypotenuses facing the opposite, counter-clockwise direction.

The root area of the first set is calculated to yield by shear, namely shaved off, under a pre-determined force applied by a driving tool (see Fig. 5) represented by the shadowed image in Fig. 13a.

The root area of the second projections is made to withstand a greater force, for unscrewing (in the appropriate cases - if at all) by turning the screw-driving tool in the counter-clockwise direction as depicted in Fig. 13b.

Once torn away by the shear force applied during the tightening stage (Fig. 13a), the second set of projections neutralizes the operation of the tool in the closing direction due to the sloping sides of the projections 240-244.

The embodiment of Figs. 14-17 is a modification of the preceding embodiment. As evident, the shear-controlled projections are those denoted 340, 342, and 344, namely located around the outer circumference of the head 310.

Also noteworthy is the fact that in this example the driving tool (seen as shadowed areas in Figs. 17a and 17b) is not identical for closing and for opening the screw (one is a mirror-image of the other).

The invention thus offers a novel and efficient solution fulfilling the objectives as specified in the preamble paragraphs above.

Those skilled in the art to which this invention pertains will readily appreciate that numerous changes, variations and modifications can be effectuated without departing from the true spirit and scope of the invention as defined in and by the appended claims.

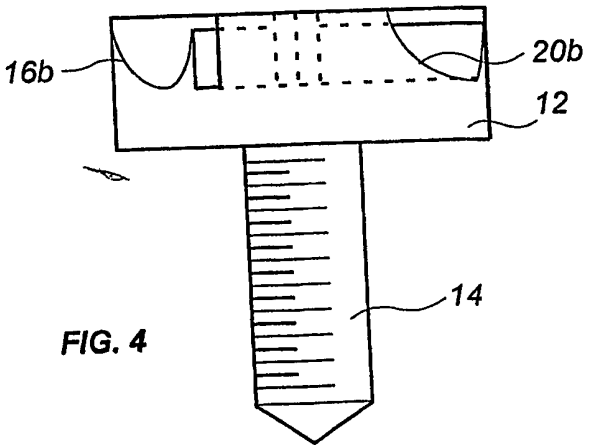
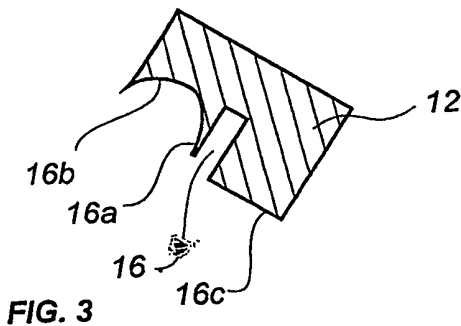
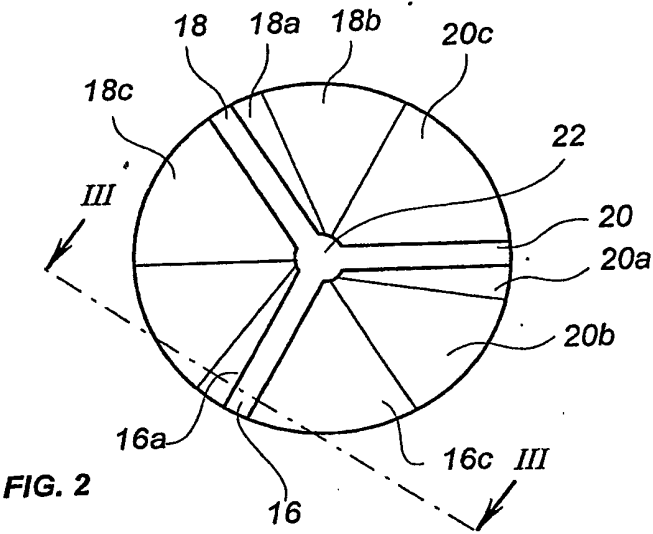
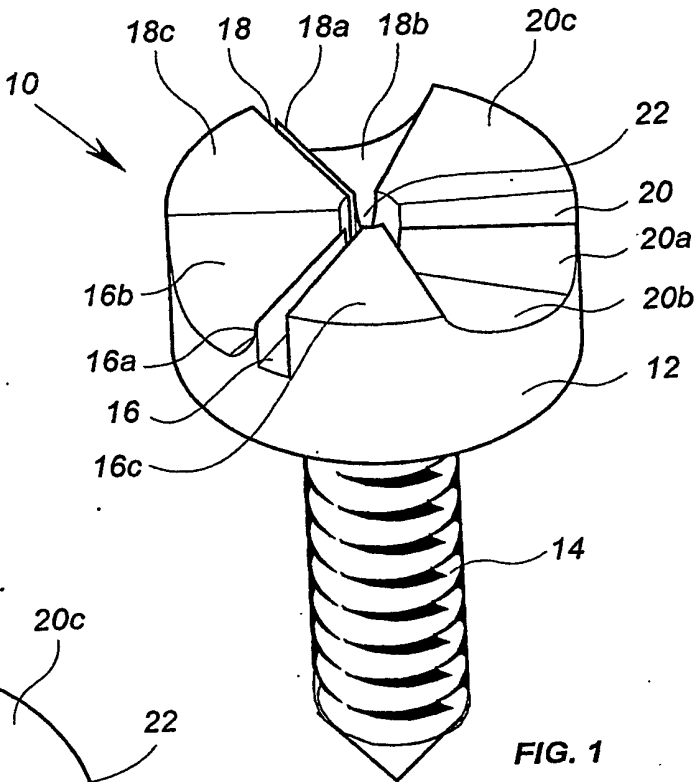
## **WHAT IS CLAIMED IS:**

1. A screw having a screw-threaded shank and a head, the head being provided with at least one screwdriver-receiving portion defined between a first, integrally formed projection of a pre-set, relatively low, shearing force resisting strength, and a second, integrally formed projection of a relatively high shearing force resisting strength.
2. The screw of Claim 1 wherein the first projection is of a generally right-angled triangular cross-section seen in a plane normal to the radial direction of the screw head.
3. The screw of Claim 2 wherein the first and the second projections are integrally formed with the head of the screw.
4. The screw of Claim 3 wherein the projections are produced by forging process applied to the screw head.
5. The screw of Claim 4 wherein the first and second portions define therebetween a slot for receiving a screwdriver tip.
6. The screw of Claim 5 wherein the root of the first projection slopes up in the clockwise direction towards the adjacent second projection.
7. The screw of Claim 6 wherein a plurality of first and second protrusions are provided, the second protrusions are of a generally isosceles triangular cross-section seen in a plane normal to the axis of the screw head.
8. The screw of Claim 2 wherein the second projection is of a generally right-angled cross-section seen in a plane normal to the radial direction of the screw head.

9. The screw substantially as hereinbefore claimed in Claim 1 and described with reference to the accompanying drawings.

For the Applicant

  
**Daniel Freimann, Adv.**



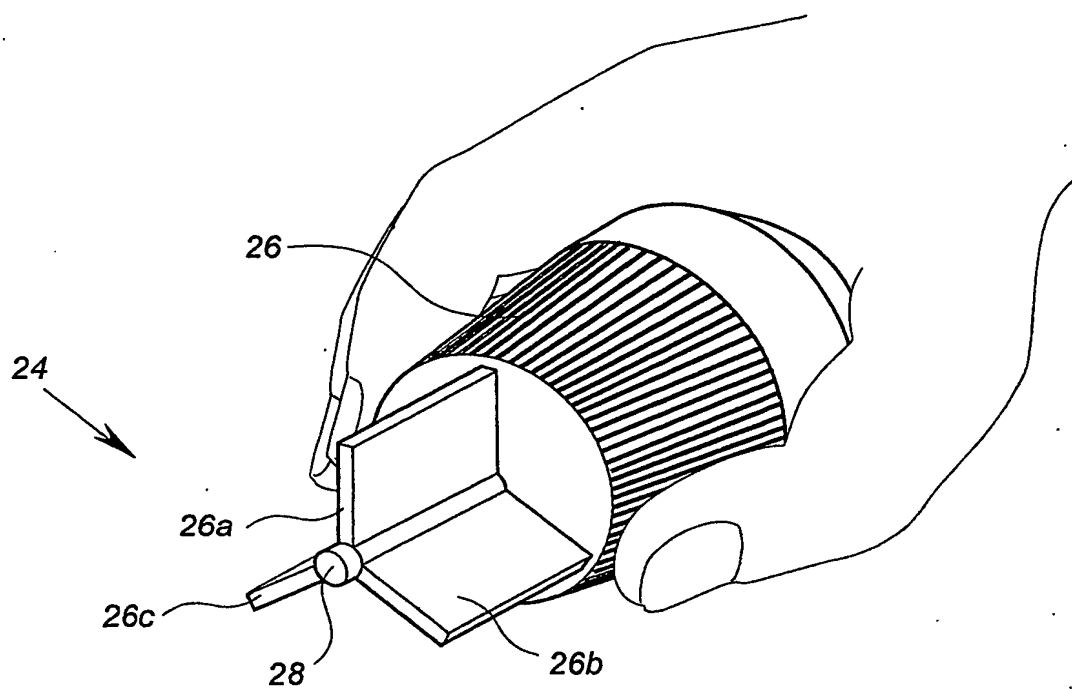


FIG. 5

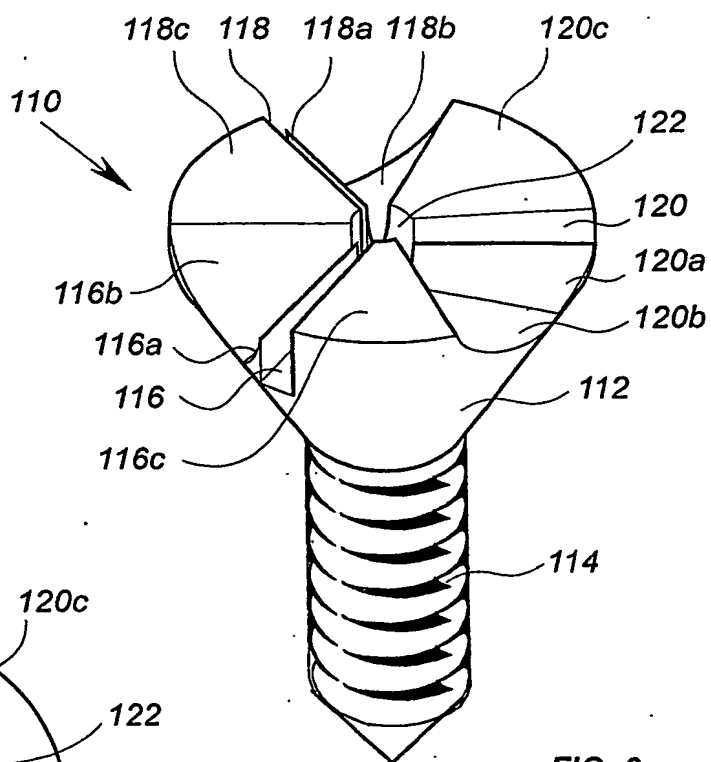


FIG. 6

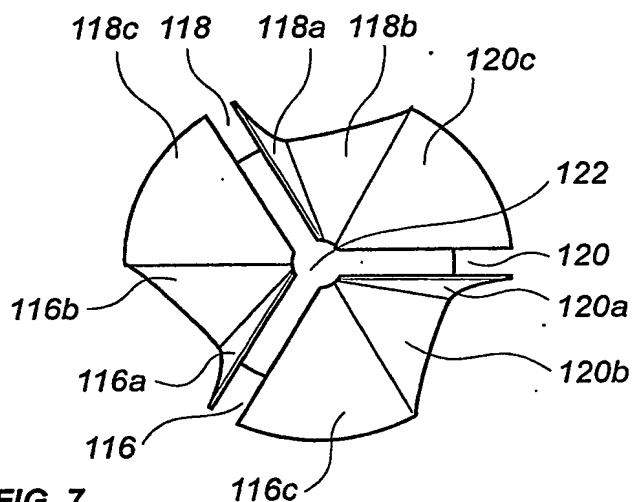


FIG. 7

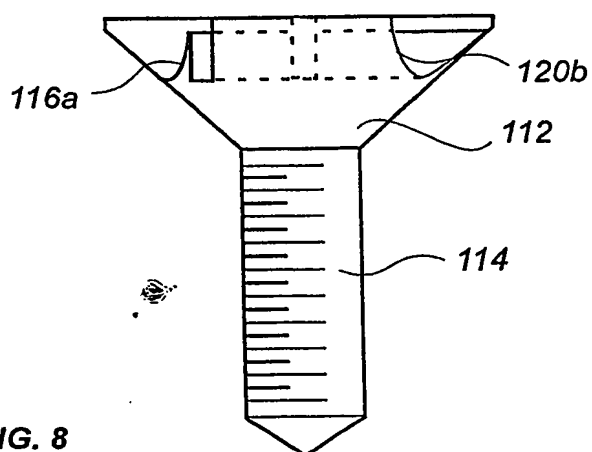
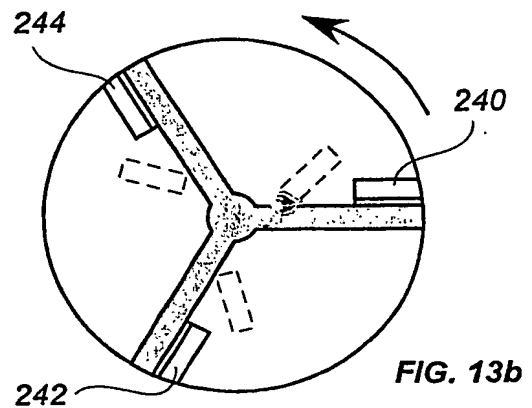
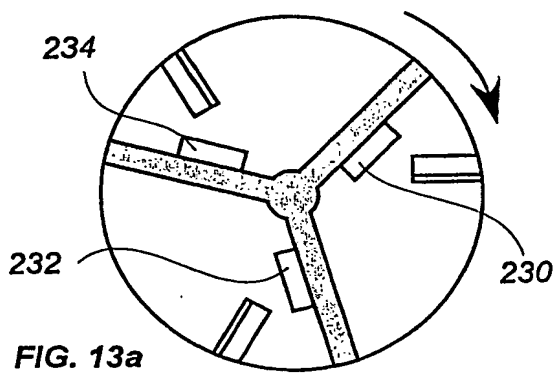
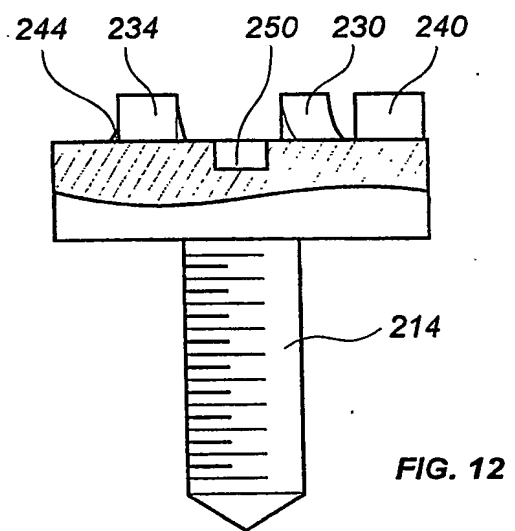
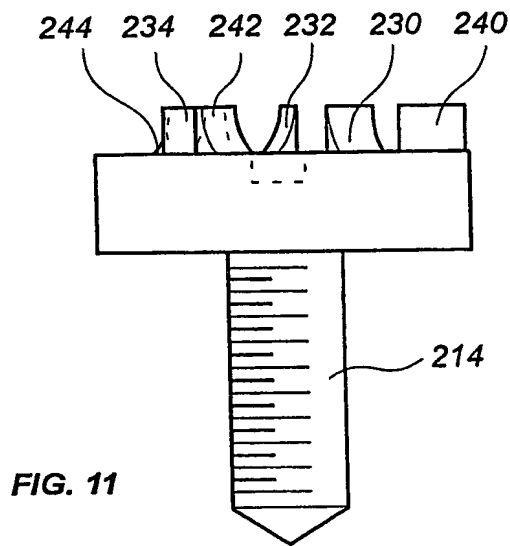
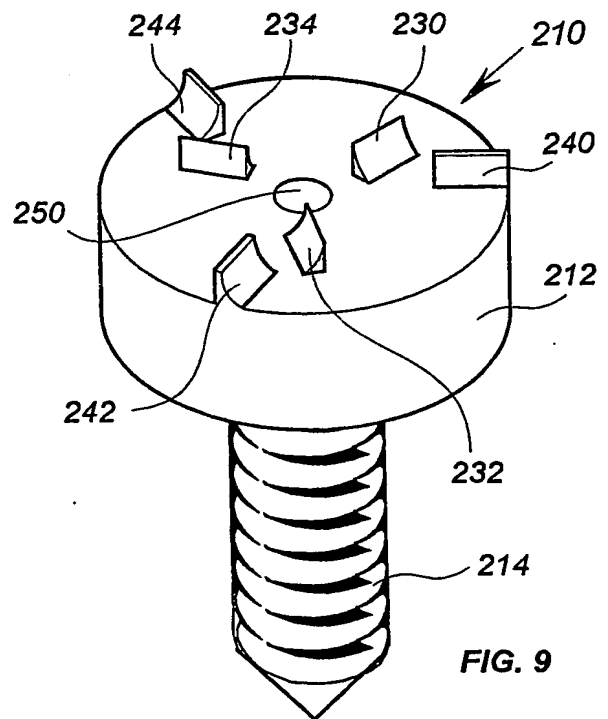
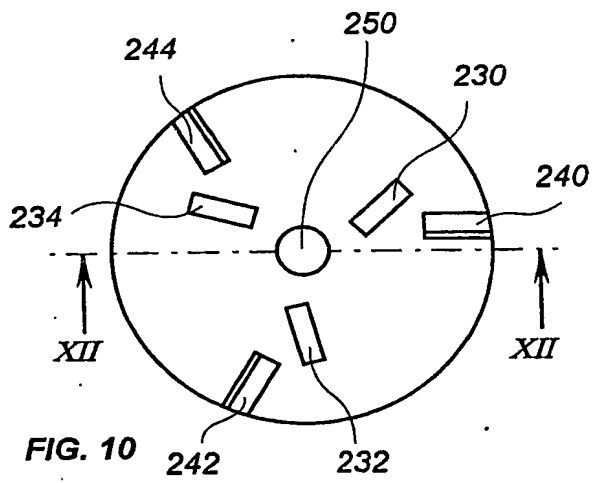


FIG. 8



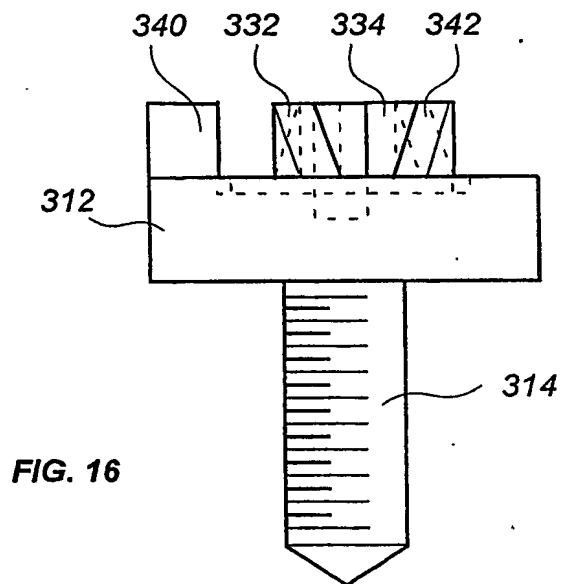
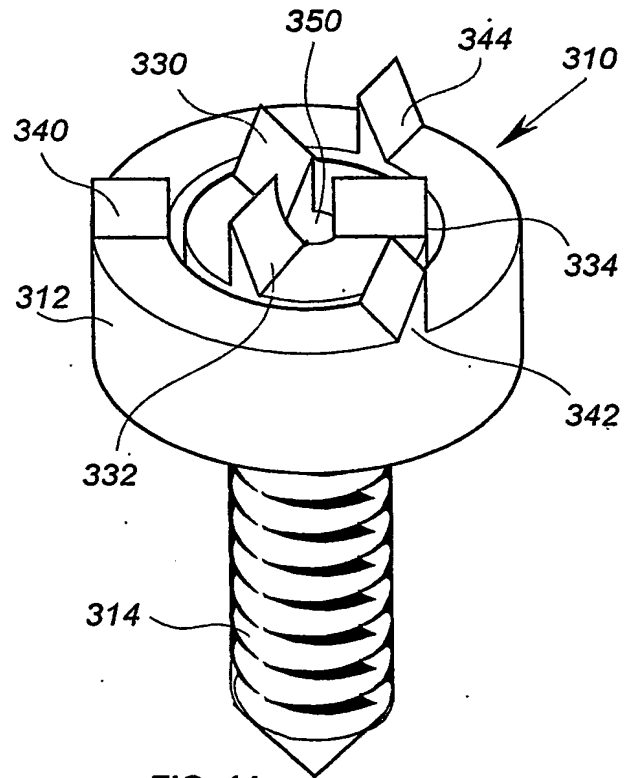
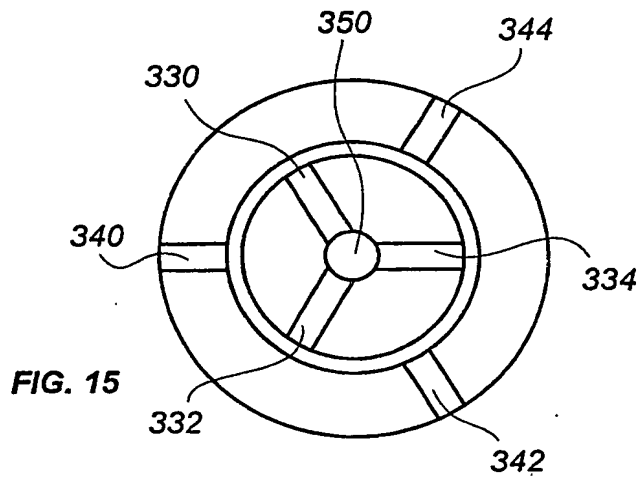


FIG. 16

FIG. 14

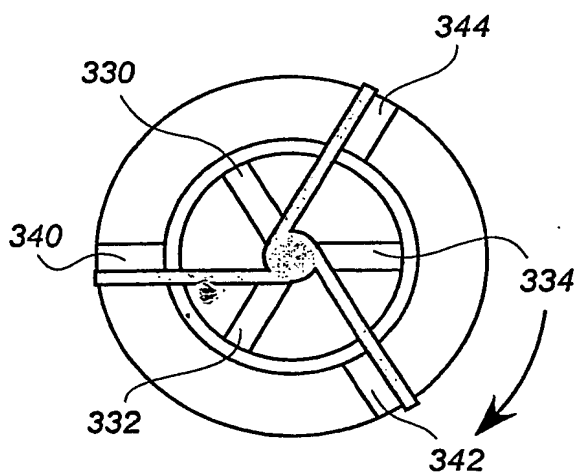


FIG. 17a

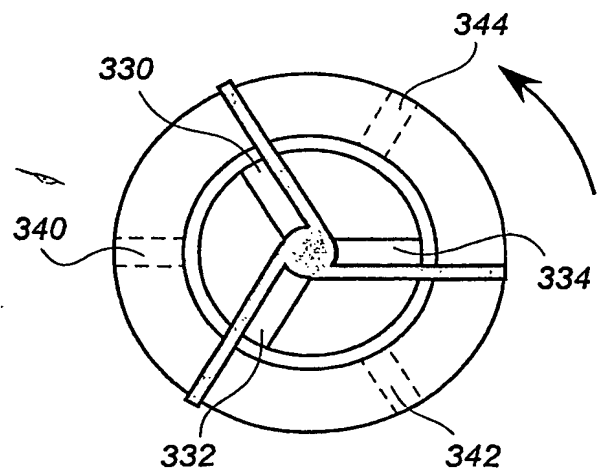


FIG. 17b

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